Remarks/Arguments

These remarks are in response to the Office Action dated May 3, 2007. This reply is timely filed. At the time of the Office Action, claims 1-17 were pending in the application. Claims 1-3, 6, 7 and 17 have been rejected under 35 U.S.C. §102(e). Claims 4, 5 and 8-16 have been rejected under 35 U.S.C. §103(a). The claim rejections are set out in more detail below.

I. Brief Review of Applicant's Invention

Prior to addressing the Examiner's rejections on the art, a brief review of Applicant's invention is appropriate. The invention concerns a method and apparatus for achieving high fidelity hearing restoration. The method includes the steps of selecting a series of audio tones within the normal range of hearing and then measuring a relative sensitivity of a test subject with respect to the ability to hear each of the audio tones, exclusive of the effects of tinnitus. The relative sensitivity of the test subject to hear the tones can be measured by determining for each tone an intensity necessary for the test subject to hear the tones at a subjectively equal loudness level. The intensity of the subjectively equal loudness level can advantageously be selected to exceed a perceived level of noise attributable to tinnitus for the test subject. The method can also include the step of determining a difference between the intensity measured for each of the tones and an intensity predicted by a standard loudness contour for each of the tones. For example, the standard loudness contour can be a Fletcher-Munson Loudness Contour.

II. Claim Rejections Under 35 U.S.C. §102(e)

Claims 1-3, 6, 7 and 17 have been rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,682,472 to Davis ("Davis"). Previously, claims 1-3, 6, 7 and 17 were rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent Application Publication No. 2004/0141624 to Davis et al. ("Davis et al."). The Examiner has withdrawn the previous rejection of claims 1-3, 6, 7 and 17 under 35 U.S.C. §102(e) because the filing date of the Davis et al. reference was not prior to the filing date of the

present application. Instead, the Examiner has found another prior art reference by the same inventor disclosing the same subject matter and which has a date applicable to a 35 U.S.C. §102(e) rejection. The Examiner is maintaining the previous rejection of claims 1-3, 6, 7 and 17 under 35 U.S.C. §102(e) using the newly cited Davis reference. However, Applicant does not agree with the rejections for the reasons set forth previously with respect to the Davis et al. reference and for the additional reasons presented below.

The Davis reference teaches a method and device for providing relief to a person suffering from the effects of tinnitus. The method includes performing a standard audiometric procedure (i.e., a hearing test) to obtain a test subject's hearing threshold values expressed in decibel hearing levels (dB HLs)(col. 10, lines 11-18). Davis explains that a standard audiometric procedure involves obtaining "hearing thresholds using TDH 39 headphones." The threshold of hearing test is a well known approach that involves measuring for each one of a series of tones, the lowest sound level that can be perceived by a subject. In this regard, Davis fails to recognize that the problem with such an approach is that the very low sound levels which are otherwise audible to a subject are often masked by the effects of the tinnitus. This problem is discussed in Applicant's specification in paragraphs 24-28. Accordingly, Davis' test results are inherently distorted by the effects of tinnitus.

In Davis, the test subject's hearing threshold values are converted from dB HLs to decibel sound pressure levels (dB SPLs) by an addition of defined transfer values (col. 10, lines 11-21). The defined transfer values can be selected as Equal Loudness Contour (ELC) transfer values (e.g., 40 Phon contour values)(*See* col. 10, lines 19-21). The ELC transfer values correct for any differences in loudness perception depending on the discreet frequencies (*See* col. 9, lines 60-67; col. 10, lines 1-10).

Subsequently, a plurality of steps are performed using the test subject's hearing threshold values expressed in dB SPLs for setting a graphic equalizer with a test subject's left and right ear required equalization response (*See* col. 10, lines 32-67 and col. 11, lines 1-7). A tinnitus rehabilitation sound (e.g., noise or music) recording is produced for use in a personal music player (*See* col. 7, lines 51-53). This sound recording production involves passing an audio signal through the graphic equalizer before being recorded thereby creating a modified sound recording (*See* col. 7, lines 53-67 and col. 8, lines 1).

Claim 1 recites a method of measuring hearing loss including the steps of selecting a series of audio tones within the normal range of hearing and measuring the relative sensitivity of a test subject with respect to the ability to hear each of the audio tones, exclusive of the effects of tinnitus. With regards to claim 1, Applicant has previously responded that the Davis et al. reference failed to teach the step of measuring a relative sensitivity of a test subject with respect to the ability to hear each of the audio tones, exclusive of the effects of tinnitus. Further, Applicant has previously responded that the hearing threshold test in the Davis et al. reference inherently includes the effects of tinnitus.

In response, the Examiner asserts that Applicant teaches measuring hearing loss at acoustic levels more than 50 dB over TOH levels in order to exclude the effect of tinnitus on such measurement. In this regard, Examiner appears to assert that Davis also teaches measuring hearing loss at audio levels which also exceed 50 dB over TOH levels. In support of this assertion, the Examiner refers to FIG. 2 and FIG. 4 in Davis. The Examiner asserts that these figures show that Davis also teaches measuring hearing thresholds at levels which exceed 50 dB over TOH levels. From this, the Examiner concludes that Davis' measurement must also be exclusive of the effects of tinnitus.

In response, Applicant notes that it has not claimed a step of measuring hearing loss at 50 dB over TOH levels. Instead, Applicant claims measuring a hearing sensitivity exclusive of the effects of tinnitus. As explained in the specification, measuring hearing sensitivity exclusive of the effects of tinnitus will generally involve steps other than choosing a particular sound level.

Notwithstanding, the foregoing, Applicant believes that the Examiner has misunderstood what is presented in FIGS. 1 and 2. In order to understand what is shown in FIGS. 1 and 2, it must first be recalled that the decibel (dB) is a logarithmic unit of measurement that expresses the magnitude of a physical quantity (usually power) relative to some reference level. Its logarithmic nature allows very large or very small ratios to be represented by a convenient number. The dB is thus essentially a ratio and a dimensionless unit. FIGS. 2 and 4 are graphical representations of typical patients' hearing thresholds and the required equalization curves using Davis' masking algorithm. The curves are expressed in terms of dB SPL where 0 dB SPL is a baseline reference value.

Thus, it should be understood that the curves in FIGS. 2 and 4 do not represent relative loudness levels of tinnitus or test tones relative to a test subject's TOH. Instead,

they merely represent a ratio of the test subject's TOH relative to a reference level. Accordingly, FIGS. 2 and 4 bear no relation to the actual loudness level that is used to perform the hearing testing.

Referring now to FIG. 2 of Davis, it can be understood that the L SPL curve shows ratio (in dB SPL) of the TOH for the test subject relative to the optimal 0 dB SPL sound level. Thus, it will be understood that the TOH for the test subject in FIG. 2 requires an audio power level that ranges up to 90 dB SPL higher as compared to a reference level. For example, at 1000 Hz, the TOH for the test subject's left ear (L SPL) was about 20 dB greater than the reference level at 0 dB. The R SPL curve in FIG. 2 provides similar information for the test subject's right ear. FIG. 4 is contains similar curves.

From the foregoing, it will be understood that the L SPL and R SPL curves in FIGS. 2 and 4 of Davis provide no information with regard to how the hearing tests were performed. Further, they do not represent relative loudness levels of tinnitus or test tones relative to a test subject's TOH. The curves are merely representations of the hearing thresholds for the test subject relative to a reference level. These figures do not teach or suggest that a hearing test should be performed at any particular loudness level which exceeds a noise level attributable to tinnitus. Accordingly, FIGS. 1 and 2 have no relevance relative to the teachings of Applicant's claimed invention.

Even though FIGS. 1 and 2 do not teach or suggest a particular measurement technique for measuring TOH, it should be noted that Davis is not silent on this point. Davis teaches at Col. 10, lines 11-12 that standard audiometric procedures should be used to measure TOH. When performing such a standard audiometric procedure for measuring TOH, the loudness of each tone will just equal or exceed a hearing threshold for a test subject at that particular frequency. However, hearing measurements at these TOH levels will be significantly influenced by the masking effects of tinnitus. Such masking will cause an ordinary threshold of hearing test to yield erroneous results.

In contrast, Applicant has claimed a measurement technique that negates the effect of the noise (tinnitus) contribution to the measurement. One approach suggested by Applicant's specification to achieve this effect involves performing such testing at a standard loudness level which always exceeds a level of noise attributable to tinnitus to ensure that the tinnitus noise has a negligible contribution to the measurement. Thereafter the test subject can subjectively determine for each tone an intensity necessary for the test subject

to hear the tone at a standard equal loudness level. All of the tone frequencies can be evaluated in this way to determine how much power is required for each tone to achieve the same subjective loudness level for the test subject. After the subject has been evaluated in this way, a difference is determined between the power level or intensity measured at each tone an intensity predicted by a standard loudness contour. For example, the standard loudness contour can be the Fletcher-Munson loudness contour discussed above.

In view of the foregoing, Applicant believes that the Examiner has failed to state a *prima facie* case for the rejection of claim 1 under 35 U.S.C. §102(e). Thus, Applicant believes claim 1 to be in condition for allowance and the rejection of under 35 U.S.C. §102(e) must be withdrawn. In addition, Applicant believes claims 2-3, 6 and 7 are in condition for allowance at least by virtue of their dependency upon allowable base claim 1.

Similarly, independent claim 17 concerns a method for measuring hearing loss. The method includes the steps of selecting a series of audio frequencies within the normal range of hearing and measuring a test subject's loss of hearing at each frequency attributable exclusively to dispersion in the hearing channel. However, it will be appreciated that measuring hearing loss "attributable exclusively to dispersion in the hearing channel" is simply a different way of stating that the measurement is performed "exclusive of the effects of tinnitus." Hearing loss is caused by dispersion in the hearing channel and by tinnitus. If a measurement is performed so as to only measure the dispersion, then the measurement is performed exclusive of the effects of tinnitus. Accordingly, Applicant believes claim 17 to be in condition for allowance for the same reasons as set forth above with regard to independent claim 1.

III. Claim Rejections Under 35 U.S.C. §103(a)

Claims 8-12, 15 and 16 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Davis in view of U.S. Patent No. 4,680,798 to Neumann. Claim 8 is dependent on independent claim 1, which has been discussed above. The remaining dependent claims rejected by the Examiner are based on independent claims 9 or 15. However, each of these claims recites the step of measuring a test subject's loss of hearing attributable exclusively to dispersion in the hearing channel. As explained above with regard to claims 1 and 17, this feature is not taught by the Davis reference. Moreover, this

deficiency in the Davis et al. reference is not cured by the disclosure or the Neumann reference.

The Neumann reference discloses a hearing aid. The hearing aid is comprised of a microphone for receiving an audio signal, preamplifiers for amplifying the received audio signal, and active band pass filters for separating the audio signal into a plurality of bandwidths. (*See* column 4, lines 50-55). The hearing aid is also comprised of digitally controllable, variable gain amplifiers for increasing the gain of a respective bandwidth. (*See* column 4, lines 61-63). The amplified bandwidths are summed together to form a spectrally modified output signal. (*See* column 5, lines 3-8). Significantly, however, Neumann does not teach or suggest the step of measuring a test subject's loss of hearing attributable exclusively to dispersion in the hearing channel.

Aside from the foregoing distinctions, claims 9 and 15 further recite the step of setting for each frequency band of a hearing aid device an audio gain level to compensate exclusively for the dispersion in the hearing channel. This step is not taught in the Davis or Neumann references. In fact, neither of these cited references disclose or teach how to determine a gain level to compensate for a hearing loss due exclusively to dispersion. Given that the references do not teach the claimed measurement, it will be readily apparent that the references also fail to teach setting a gain level for a hearing aid device based on such a measurement.

As noted above, the Neumann reference discloses a hearing aid device in which audio gain levels for frequency bands can be set. However, the Neumann reference fails to disclose or teach measuring a test subject's loss of hearing attributable *exclusively* to dispersion in the hearing channel and setting for each frequency band of the hearing aid device an audio gain level to compensate *exclusively* for the dispersion. Instead, the Neumann reference discloses and teaches storing bandwidth interdependent, frequency response information in a memory of the hearing aid. (*See* column 3, lines 14-19). This information is provided for use in determining and setting gain levels of variable gain amplifiers for increasing the gain of a respective bandwidth. The Neumann reference further discloses and teaches a hearing aid device having a means for introducing noise into a signal including amplified bandwidths for providing treatment for tinnitus. (*See* column 3, lines 3-8). This noise is referred to in the art of audiology as background or "white" noise which reduces the effects of tinnitus. Accordingly, a person skilled in the art is

left to interpret the Neumann reference as disclosing and teaching performing a "standard audiometric procedure" to obtain the bandwidth interdependent, frequency response information required to set audio gain levels for frequency bands since the effects of tinnitus are still present in the signal including amplified bandwidths and are dealt with by introducing "white" noise into the signal.

In view of the foregoing, Applicant believes the Examiner has failed to state a *prima facie* case for the rejection of claims 9 and 15 on obviousness-type grounds under 35 U.S.C. §103(a). Thus, Applicant believes claims 9 and 15 are in condition for allowance and the rejection under 35 U.S.C. §103(a) must be withdrawn. In addition, Applicant believes claim 8 is in condition for allowance at least by virtue of its dependency upon allowable base claim 1. Further, Applicant believes claims 9-12 are in condition for allowance at least by virtue of their dependency upon allowable base claim 9.

Independent claim 16 relates to a hearing aid device for a person suffering from tinnitus. Specifically, claim 16 recites an audio amplification device having a plurality of audio frequency bands with selectable gain levels. Each of the gain levels is set for producing a predetermined amount of audio gain set to compensate *exclusively* for dispersion losses in the hearing channel.

In view of the discussion concerning claims 1 and 17, Applicant believes that the Davis reference does not teach an audio amplification device having a plurality of audio frequency bands with selectable gain levels set to compensate *exclusively* for dispersion. Similarly, the Neumann reference fails to disclose and teach a hearing device having gain levels set for producing a predetermined amount of audio gain set to compensate *exclusively* for dispersion losses in the hearing channel. In this regard, Applicant believes that the Neumann reference teaches a hearing aid device having a means for introducing noise into a signal including amplified bandwidths for providing treatment for tinnitus. (*See* column 3, lines 3-8). This noise is referred to in the art of audiology as background or "white" noise which reduces the effects of tinnitus. Accordingly, a person skilled in the art is left to interpret Neumann as disclosing and teaching performing a "standard audiometric procedure" to obtain the bandwidth interdependent, frequency response information required to set audio gain levels for frequency bands. As such, the Neumann reference teaches a hearing device having gain levels set for producing a predetermined amount of

audio gain set to compensate for dispersion losses in the hearing channel and noise attributable to tinnitus.

In view of the foregoing, Applicant believes the Examiner has failed to state a *prima facie* case for the rejection of claim 16 on obviousness-type grounds under 35 U.S.C. §103(a). Thus, Applicant believes claim 16 is in condition for allowance and the rejection under 35 U.S.C. §103(a) must be withdrawn.

Claims 4, 5, 13 and 14 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Davis in view of U.S. patent no. 6,602,202 to John et al. ("John et al."). The John et al. reference teaches an apparatus and method for assessing a subject's hearing by recording steady-state auditory evoked responses. The apparatus generates a steady-state auditory evoked potential stimulus (SSAEP), presents the SSAEP to the subject, senses potentials while simultaneously presenting the stimulus and determines whether the sensed potentials contain responses to the stimulus. The sensed potentials are the subject's electroencephalogram (EEG) which contains the subject's response to the stimulus if the subject's auditory system has processed the stimulus. The apparatus and method are used on subjects where conventional audiometry cannot be performed. Such subjects include infants, young children or cognitively impaired adults who cannot make a conscious response to a series of audio tones in conventional audiometry.

Independent claim 4 recites a method for accurately measuring hearing loss including the step of selecting a series of audio tones within the normal range of hearing. Claim 4 includes the step of measuring a relative sensitivity of a test subject with respect to the ability to hear each of said audio tones, exclusive of the effects of tinnitus. Claim 4 includes the step of determining for each tone an intensity necessary for the test subject to hear the tones at a subjectively equal loudness level. Claim 4 includes the step of determining a difference between the intensity measured for each of the tones and an intensity predicted by a standard loudness contour for each of the tones.

As previously discussed, the Davis reference teaches a method and device for providing relief to a person suffering from the effects of tinnitus. The method includes performing a standard audiometric procedure (i.e., a hearing test) to obtain a test subject's hearing threshold values expressed in decibel hearing levels (dB HLs)(col. 10, lines 11-18). Thereafter, the test subject's hearing threshold values are converted from dB HLs to decibel sound pressure levels (dB SPLs) by an addition of defined transfer values (col. 10, lines 11-

21). The Examiner concedes that the Davis reference fails to teach determining a difference between the intensity measured for each of the tones and intensity predicted by a standard loudness contour for each of the tones.

However, as discussed above, the John et al. reference does not teach using a series of tones for assessing a subject's hearing. The John et al. reference teaches using steady-state auditory evoked potential stimulus (SSAEP) to a subject and determining whether sensed potentials (EEG) contain responses to the stimulus. Accordingly, Applicant believes that the John et al. reference does not make up for the deficiencies of the Davis reference. Moreover, there is no teaching or suggestion for the combination proposed by the Examiner as is required for a rejection under 35 U.S.C. §103(a). Thus, Applicant believes that the Examiner has failed to state a *prima facie* case of obviousness under 35 U.S.C. §103(a).

In view of the foregoing, Applicant believes claim 4 is in condition for allowance and the rejection under 35 U.S.C. §103(a) must be withdrawn. In addition, Applicant believes claim 5 is in condition for allowance at least by virtue of its dependency upon allowable base claim 4.

Independent claim 13 recites a method for setting a frequency dependent audio gain of a hearing aid device for a person suffering from tinnitus including steps identical or similar to the steps recited in independent claim 4 including the step of measuring a test subject's loss of hearing comprises selecting a series of audio tones within the normal range of hearing and measuring a relative sensitivity of said test subject with respect to the ability to hear each of said audio tones, exclusive of the effects of tinnitus. For the reasons discussed above with respect to claim 4, Applicant believes that the John et al. reference does not make up for the deficiencies of the Davis reference. Moreover, there is no teaching or suggestion for the combination proposed by the Examiner as is required for a rejection under 35 U.S.C. §103(a). Thus, Applicant believes that the Examiner has failed to state a *prima facie* case of obviousness under 35 U.S.C. §103(a).

In view of the foregoing, Applicant believes claim 13 is in condition for allowance and the rejection under 35 U.S.C. §103(a) must be withdrawn. In addition, Applicant believes claim 14 is in condition for allowance at least by virtue of its dependency upon allowable base claim 13.

V. Conclusion

Applicant has made every effort to present claims which distinguish over the prior art, and it is believed that all claims are in condition for allowance. Nevertheless, Applicant invites the Examiner to call the undersigned if it is believed that a telephonic interview would expedite the prosecution of the application to an allowance. In view of the foregoing remarks, Applicant respectfully request reconsideration and prompt allowance of the pending claims.

Respectfully submitted,

7-30-07
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